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ABSTRACT

Down Syndrome children exhibit language delays, particularly in expressive abilities, more severe than would be anticipated from their cognitive level alone. This research project sought to develop a procedure for introducing total communication into the home environment of prelinguistic Down Syndrome infants and for comparing the relative effectiveness of the oral and total communication approaches on an individual basis. A play-based language intervention was designed, using a single-subject simultaneous treatment design to evaluate a 14-month-old Down Syndrome child's progress in both speech and total communication modalities. Two equivalent 10-word sets were introduced during free play; with one set of 10 toys, manual signs augmented speech, while for the other 10 toys only speech was used. Results indicated that comprehension was not differentially affected by the type of communication approach used. However, the child was able to use manual signs expressively many months before any understandable words were used. His use of manual signs did not inhibit his use of speech. (Author/JDD)

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EARLY USE OF TOTAL COMMUNICATION WITH A YOUNG DOWN SYNDROME CHILD:
A PROCEDURE FOR EVALUATING EFFECTIVENESS

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ABSTRACT

A review of the literature provides a strong rationale for using a Total Communication approach (TC) with Down Syndrome infants and young children since they exhibit language delays, particularly in expressive abilities, more severe than would be anticipated from their cognitive level alone. This specific language delay may arise in DS children because they have a tendency to get frequent ear infections and hence experience intermittent hearing loss, they have oral motor problems as a result of hypotonicity and structural differences in their oral mechanism, and they may exhibit specific auditory processing problems. The current research was designed to evaluate the effectiveness of using a TC approach with a young child with Down syndrome. A single subject simultaneous treatment design was used which involved choosing two equivalent 10 word sets matched on phonetic complexity and reinforcement value. Words were introduced during naturalistic free play sessions. With one set of toys, manual signs augmented speech while for the other toy set only speech was used. Results indicated that comprehension was not differentially affected by the type of communication approach used. However, expressively the child was able to use manual signs many months before any understandable words were used. His use of manual signs did not inhibit his use of speech. In fact, as he acquired speech, he began to accompany his signs with the appropriate spoken words. The effectiveness of TC in promoting this child's communicative ability suggests that TC may be effective for other children with Down Syndrome if introduced early and as a transitional mode of communication.

EARLY USE OF TOTAL COMMUNICATION WITH YOUNG DOWN SYNDROME CHILDREN:A PROCEDURE FOR EVALUATING EFFECTIVENESS

Total Communication, the simultaneous use of speech and manual signs, has become widely-used as a method to facilitate communication in autistic and nonverbal, retarded children. In general, researchers have found that the Total Communication (TC) approach enhances individuals' receptive and instruction-following abilities (Bricker, 1972; Kohl, Karlan & Heal, 1979) and increases their expressive communicative abilities, particularly in the sign modality (Barrera, Lobato-Barrera & Sulzer-Azaroff, 1980; Bonvillian, Nelson & Rhyne, 1981; Jones, 1980; Stremmel-Campbell, Cantrell & Halle, 1977). For example, in their review of studies of autistic children trained using TC, Bonvillian et al., (1981) found that the majority of these children acquired the ability to produce five or more signs. Whether TC intervention facilitates verbal speech production is less clear. Carr's (1979) review indicates that less than one quarter of the initially nonverbal autistic children trained using TC actually developed speech and that the vocabularies of those who did acquire speech were typically quite limited. On the other hand, other studies suggest that sign may facilitate speech production particularly in mentally retarded, nonautistic children (Grinell, Detamore & Lippke, 1976; Kahn, 1977; Stremmel-Campbell et al, 1977). Given the documented effectiveness of TC interventions with mentally retarded individuals, speech pathologists and early intervention professionals have questioned whether the use of TC is appropriate or necessary for young children with Down Syndrome.

A review of the literature suggests a rationale for using sign language with young Down Syndrome children. Research has revealed that children with Down Syndrome exhibit language delays, particularly in expressive abilities, more severe than would be anticipated from their cognitive level alone (Beegly, Hanrahan, Weiss & Cicchetti, 1985; Cardoso-Martins, Mervis & Mervis, 1985; Mahoney, Glover & Finger, 1981; Thompson, 1963). For example, Mahoney et al. (1981) found that children with Down Syndrome (DS) scored lower on the vocal imitation scale of the Uzgiris and Hunt (1975) Scales of Infant Psychological Development (U-H) and scored lower on both the receptive and expressive scales of the Receptive-Expressive Emergent Language Scale (REEL) (Bzoch & League, 1970) than a nonhandicapped (NH) group matched on mental age (MA). Interestingly, the DS children scored higher on the means-ends scale of the U-H assessment. In another study, Beegly et al. (1985) matched DS children with two NH groups, one on MA and the other on Mean Length of Utterance (MLU). They found that DS children had significantly lower MLUs than MA-matched NH children. On the other hand, they found that the pragmatic skills (i.e., turntaking ability, diversity of speech acts) of DS children were more advanced than those of MLU-matched children but equivalent to MA-matched NH children. Cardoso-Martins et al. (1985) reported that the onset of receptive and expressive verbal ability occurred at similar developmental levels in DS and NH children. However, the further development of both receptive and expressive ability was delayed in DS children when compared to NH children at the same level of sensorimotor development. All the above findings indicate that the language skills of DS children are delayed compared to their other cognitive and communicative abilities.

Miller (1987) suggests that specific language delays may arise in DS children for a number of reasons. First, children with DS have a tendency to get frequent ear infections and hence experience intermittent hearing loss. Second, oral motor problems may exist as a result of hypotonicity and structural differences (i.e. diminished oral cavity, enlarged tongue) (Gibson, 1975). Finally, specific cognitive deficits such as auditory processing problems (Pueschel, Gallagher, Zartler & Pezzullo, 1987) or decreased responsiveness of both partners in dyadic interaction have been hypothesized to underlie the language disabilities of DS children.

Given the evidence of a specific verbal language disability among children with DS and suggestions that these children function more appropriately in nonverbal areas, such as gestural and pragmatic abilities, it is likely that TC intervention could provide an effective means of diminishing the early language delay by providing an augmentative and transitional mode of communication for young children with DS. Specifically, TC would provide an alternative mode of communication during periods of hearing loss; it would circumvent early oral-motor problems; and it might increase the interactional responsiveness of both members of the dyad.

The few studies which have compared the relative effectiveness of oral and total communication approaches with young children with DS suggest that these children generally acquire signs more easily than words. Reich (1978) randomly assigned commonly used words to oral and total communication approaches and used the words or words/signs in a naturalistic manner with a preschool class of children with DS. After two to three weeks, children were spontaneously using more of the signed than oral words. Weller and Mahoney (1983) compared two groups of preschoolers, one taught with total

communication and the other taught with oral methods and found that the total communication group had developed larger overall vocabularies. However, they found no evidence that total communication training had any impact on oral language development in either a positive or negative direction. Work from Abrahamsen, Cavallo and McCluer's (1985) total communication preschool with NH and DS children indicated that children with DS, compared to NH children of similar developmental ages, were delayed in word production but were similar in their use of signs. This "sign advantage" was found to diminish as the DS children later acquired spoken language. Thus, these studies support the use of total communication intervention with children with DS particularly if it is introduced early as a transitional mode of communication.

The goal of the current research was to develop a procedure for introducing TC into the home environment of prelinguistic Down Syndrome infants and for comparing the relative effectiveness of the oral and total communication approaches on an individual basis. We were particularly interested in designing a procedure which could easily be used by speech pathologists or developmental specialists working with individual infants and their families on a one-to-one basis as is common among early intervention programs. To do this, we developed a play-based language intervention which uses a single-subject simultaneous treatment design to evaluate the child's progress in both speech and TC modalities. The specific questions being addressed were whether the augmentative use of TC: a) promotes the infant's comprehension, b) promotes the infant's expressive communication in a sign modality, or c) promotes the infant's speech production?

METHOD

Subject

The subject, Christopher B., was a 14 month old male with Down Syndrome. The diagnosis of Down Syndrome (Trisomy 21) was made at birth and confirmed by chromosomal analysis. He was an only child who lived at home with his parents and attended a local early intervention program. His mother was his primary caregiver, but both parents were actively involved in Christopher's educational programming and in this study.

Christopher was the result of a first pregnancy that was reportedly normal until the end, when his mother was hospitalized because of placenta previa. Christopher was born 2 weeks prematurely, and received phototherapy for neonatal jaundice. He underwent cardiac surgery at 6 months of age to repair atrioventricular canal heart defect. Otherwise, Christopher's medical history was unremarkable. He did not have a history of ear infections.

Christopher began attending an early intervention program when he was 6 weeks old. His attendance was regular except during treatment of his heart defect. Programming consisted of weekly two hour sessions during which he received one hour of physical, occupational, speech/language, and/or educational therapy, and one hour of group activities with other children.

Speech/language therapy prior to the initiation of this study had focused on improving Christopher's auditory skills and his prelinguistic skills such as attending to a speaker, reciprocal babbling, and communicative pointing. He was exposed to language concepts regularly through the use of a variety of common objects and toys. Neuromuscular facilitation techniques were also used throughout therapy to enhance Christopher's oral motor development.

Initial Assessment. At the onset of this study, when Christopher was 14 months old, his cognitive skills ranged between the 6 and 12 month level, as assessed using the Early Learning Accomplishment Profile (Glover, Preminger & Sanford, 1978). On the U-H Scales Christopher's modal level of functioning on the U-H Scales was Stage IV. However, his skills varied widely with his Object Permanence and Means-ends abilities at a Stage V level and his Vocal Imitation ability at a Stage II level. On the Bayley Scales of Infant Development, administered at 19 months, Christopher achieved a Mental Development Index of 63 and an approximate test age of 15 months. On the motor scale, he achieved a Psychomotor Development Index of 62 and an approximate test age of 13 months.

In terms of his language development at 14 months, Christopher was not using any words expressively and was not able to consistently pick out objects by their name. Evaluation with the REEL indicated that his receptive language skills were at the 10-11 month level of development while his expressive skills ranged between the 7 and 11 month levels. Christopher's hearing was assessed by an audiologist at 6 and 12 months of age and found to be within normal limits.

Based on his diagnosis, age, prelinguistic stage of development, and previous lack of exposure to total communication, Christopher was selected for participation in this study.

Design

Two equivalent word sets were developed by matching words on their phonetic complexity and reinforcement value. Developmentally appropriate toys or objects were selected to correspond to the target words and were introduced during naturalistic free play sessions. Following a simultaneous treatment

design, manual signs augmented oral speech during play with one set of objects, while only oral speech was used with the other set. Parents alternated the total communication and oral play sessions and typically engaged in a total of four half-hour play sessions each week. For generalization purposes, they also used the words and signs for the appropriate objects as they were encountered throughout the day.

Procedure

Development of Word Lists. In order to utilize words in this study that were significant to Christopher, his parents provided the authors with a list of 50 nouns relevant to him in his home environment. Additional typical early nouns were selected from MacDonald (1978) and Fristoe and Lloyd (1979). The total list of 85 possible words were then rated by the parents in terms of: (a) Reinforcement Value (4 point scale: 1 = Dislikes; 2 = Neither likes nor dislikes; 3 = Likes; 4 = Really Likes) and (b) Exposure (5 Point Scale: 1 = Not at all or very rarely; 2 = At least once a month; 3 = At least once a week; 4 = Once or twice a day; and 5 = Three or more times a day.)

In addition, each word was rated in terms of its phonetic complexity using Sander's (1972) average age estimates of customary consonant production. The first consonant of each syllable was scored according to the age it is typically produced. The scores of both first consonants in two syllable words were added to reflect the increased difficulty of producing two syllable words. Words beginning with blends were not scored, and were matched with other initial blend words.

Before matching occurred, a number of words were eliminated. Reasons for elimination included: (a) sign was too similar to a non-sign gesture (i.e. pointing to nose for nose); (b) did not want to introduce item (i.e. candy);

(c) difficult to integrate into a free play session (i.e. wall); (d) concept deemed too abstract (i.e. birthday).

The final two word sets were selected by choosing ten pairs of words which matched on both phonetic complexity and exposure. From each pair, the words were randomly assigned to the total communication or oral set. The final words selected are listed in Table 1. Signs representing each word were selected from Bornstein's (1983) Comprehensive Signed English Dictionary. The motor planning complexity of each sign was rated using Dennis, Reichle and Williams' (1981) movement pattern scale: (a) Unilateral (1 point); (b) Bilateral Mirror Movements (2 points); (c) Unilateral, Across Midline (3 points); (d) Bilateral Base/Mover at Midline (4 points); (e) Bilateral Separate Handshapes at Midline (5 points); (f) Bilateral Crossing Midline (6 points).

Although words were not matched on amount of exposure and motor complexity, final word lists were compared on these factors to ensure that they were similar for each word set. The average exposure rating oral words was 2.6 (sd = 1.5) and for TC words was 2.9 (sd = 1.8). The average motor complexity score was 2.9 (sd = 1.6) and 3.0 (sd = 1.3) for oral and total communication words, respectively.

Play Sessions

Given Christopher's age and limited attention span, initially only half the words in each set were introduced. After 3 months, when he began to demonstrate initial comprehension of object names, the second 5 words of each set were added. The signs for each appropriate toy were taught to the parents, and they were reminded to always pair the spoken word with the sign. Information was provided to the parents on how they could help shape

Christopher's sign production through hand over hand assistance. They were also given information on the typical pattern of emergence of sign production (i.e., typically seeing correct movement first, then correct position in space, and finally correct handshape).

Christopher's parents engaged in play sessions four times a week, always alternating the toy set used to promote equal exposure. They were encouraged to play naturally with Christopher using the toys. During early sessions they needed to call his attention to the toys during play, but as Christopher matured, he frequently initiated the toy interactions independently.

Two weeks after introducing the program, Christopher's parents were videotaped conducting both play sessions. The tape was reviewed by the parents with the authors, to discuss strengths and weaknesses of the sessions. Specific strategies to enhance the effectiveness of the parental modeling of words and signs were recommended. These included gaining Christopher's attention before labeling a toy with a word/sign, and reducing the number of times an object was labeled in order to facilitate a more natural play situation.

Dependent Measures

Comprehension Testing. To assess Christopher's comprehension of targeted words, a forced choice task format was used. Each targeted item was presented along with two foils and Christopher was asked to give the target object to the examiner. Three trials were conducted for each target item, changing the placement of target and foils for each trial. Comprehension testing occurred once a month for 3 months, then biweekly until Christopher had achieved an average of 80% correct responses.

Expressive Language Measures. From the beginning of the study Christopher's parents maintained an ongoing diary of the words and signs he used both spontaneously and imitatively. This diary included both his use of targeted words and any other word acquired. In addition, formal expression testing was initiated when Chris was 19 months. Christopher was presented each target item and asked to name it. Expression testing was conducted on a monthly basis.

Parent Training and Reliability. Parents were trained to administer both the comprehension and expression testing. To ensure appropriate administration and reliability, the speech pathologist observed and scored every fourth administration. Reliability ranged between 95% and 100% ($M = 97.5$).

RESULTS

Data was collected from the initiation of the study when Christopher was 14 months until he was 28 months of age. By 19 months, his modal level of cognitive functioning had progressed from Stage IV to Stage V with his best performance remaining in the Object Permanence domain (Stage VI) and his poorest in Vocal Imitation (Stage IV). A graph of Christopher's progress on the U-H is presented in Figure 1.

During the second month, the parents, of their own volition, decided to introduce the sign "more". During the third month they began to introduce other signs for common words and actions (i.e., eat, hat). However, at no point were signs used for targeted oral words.

Language Comprehension

To determine Christopher's general level of comprehension for the targeted words, the average percent of correct responses on the comprehension test was calculated by averaging across all words in a set. As can be seen in

Figure 2. Christopher's ability to comprehend the targeted total communication words and oral words increased over the first few months and then stabilized at a level where he was choosing the correct items approximately 2/3 of the time. His comprehension abilities were not differentially affected by the type of communication approach used.

Expressive Language Ability

Evidence for the initial superiority of the TC approach at enhancing Christopher's communicative lexicon can be seen in the ongoing reports of his expressive language kept by his parents. As shown in Figure 3, Christopher quickly acquired more signs than spoken words. By the end of the first six months of intervention, Christopher had spontaneously produced 17 signs but only four spoken words. At around 2 years of age, Christopher's use of speech began to increase and by 28 months his expressive vocabulary in the speech mode had surpassed his sign vocabulary. By 28 months, most of Christopher's signs were accompanied by the appropriate spoken word.

To more objectively examine the effectiveness of the TC approach, we examined his acquisition of only those 10 targeted words in each modality. As shown in Figure 4, Christopher made greater progress in acquiring the target signs than the target oral words. By 23 months, he had used 8 of the 10 targets signs spontaneously but had only spoken two object names. A sharp increase in his ability to label target objects occurred between 24 and 26 months.

Christopher's use of manual signs did not appear to inhibit his oral speech production. In fact, as can be seen in Figure 4., he began to use speech at a similar rate for both word sets. For example, at 28 months, Christopher identified 7 of the 10 targeted TC words using both manual signs

and the spoken word approximation. He labeled 6 of the 10 oral words. Thus, TC appears to offer the child an early mode of expressive communication which does not interfere with oral speech development.

DISCUSSION

A review of the literature suggests that children with Down Syndrome are at-risk for specific delays in verbal language development which are more severe than their general cognitive delay. This study sought to develop a procedure for introducing augmentative TC intervention to prelinguistic children which would also evaluate each child's progress in an individualized manner.

Our results indicate that introducing sign language through naturalized play sessions was highly feasible and enjoyable to the parents and child. In addition, the evaluation effort was attractive to the parents who were initially somewhat uncertain of the value of using TC.

For Christopher, it was apparent that he was able to use manual signs many months before any understandable words were used consistently. We believe that providing Christopher and his parents with an alternate mode of communication enhanced the quality of their parent-child interaction, particularly the extent to which the parents exposed their child to linguistic information and the extent of that Christopher was responsive to communicative input. In support of this, his parents express much satisfaction and pleasure in being able to communicate with their son about objects in the world and about his wants and needs. However, specific documentation of this benefit would require research which compares families who have and have not used a TC approach.

The finding that comprehension was not enhanced by the use of manual signs supports the notion that, for this child, the verbal language delay was predominantly the result of an output problem, perhaps resulting from the effects of hypotonicity on the oral-motor mechanism.

Finally, the results obtained indicate that Christopher's use of oral speech was not inhibited by the use of manual signs. In fact, as he acquired speech, he began to accompany his manual signs with the appropriate words. Although the early use of TC clearly promoted Christopher's communicative ability, there is no indication that his oral speech developed more rapidly. Nonetheless, by 2 years of age, Christopher has an expressive vocabulary of 16 words and 34 signs. By 2 1/2 years of age, he had an expressive vocabulary of over 70 words and over 50 signs and was using 2 and 3 word combinations (e.g., "Want cracker", "That my daddy"). Comparing his abilities to those of other children with Down Syndrome, his language abilities are well above average (Doret, Matheson, Rosenblum, 1987; Pueschel, Canning, Murphy, & Zausner, 1979). We will never know exactly how much of his excellent progress in language was the result of his early exposure to TC, his own innate ability, or his parents' exceptional care and responsiveness. What we do know is that the early use of TC provided Christopher and his family with an enjoyable mode of communication at a time when he was cognitively ready to express himself yet lacked sufficient verbal speech ability to express himself in that modality. The effectiveness of using TC with Christopher suggests that a TC approach may be appropriate for other young children with Down syndrome. The procedure developed here offers speech pathologists and early intervention specialists with a means of introducing and evaluating the effectiveness of using a TC approach independently for each individual child.

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Table 1. List of Target Words and Ratings of Phonetic Complexity and Reinforcement Value

<u>ORAL WORDS</u>	<u>SIGNED WORDS</u>	<u>PHONETIC COMPLEXITY</u>	<u>REINFORCEMENT VALUE</u>
Bird	Bell	1.5	2
Bug	Boat	1.5	3
Bottle	Water	3.5	4
Bubble	Paper	3.0	4
Spoon	Block	Blend	3
Milk	Book	1.5	4
Money	Soap	3.0	2
Plane	Glasses	Blend	2
Shoe	Pudding	3.5	2
Table	Chair	3.5	3

Uzgiris and Hunt Scales of Infant Psychological Development PROFILE OF ABILITIES FORM

Child's Name _____	Sex _____
Date of Birth _____	Age _____
Examiner _____	Date of Test _____
Comments: _____	

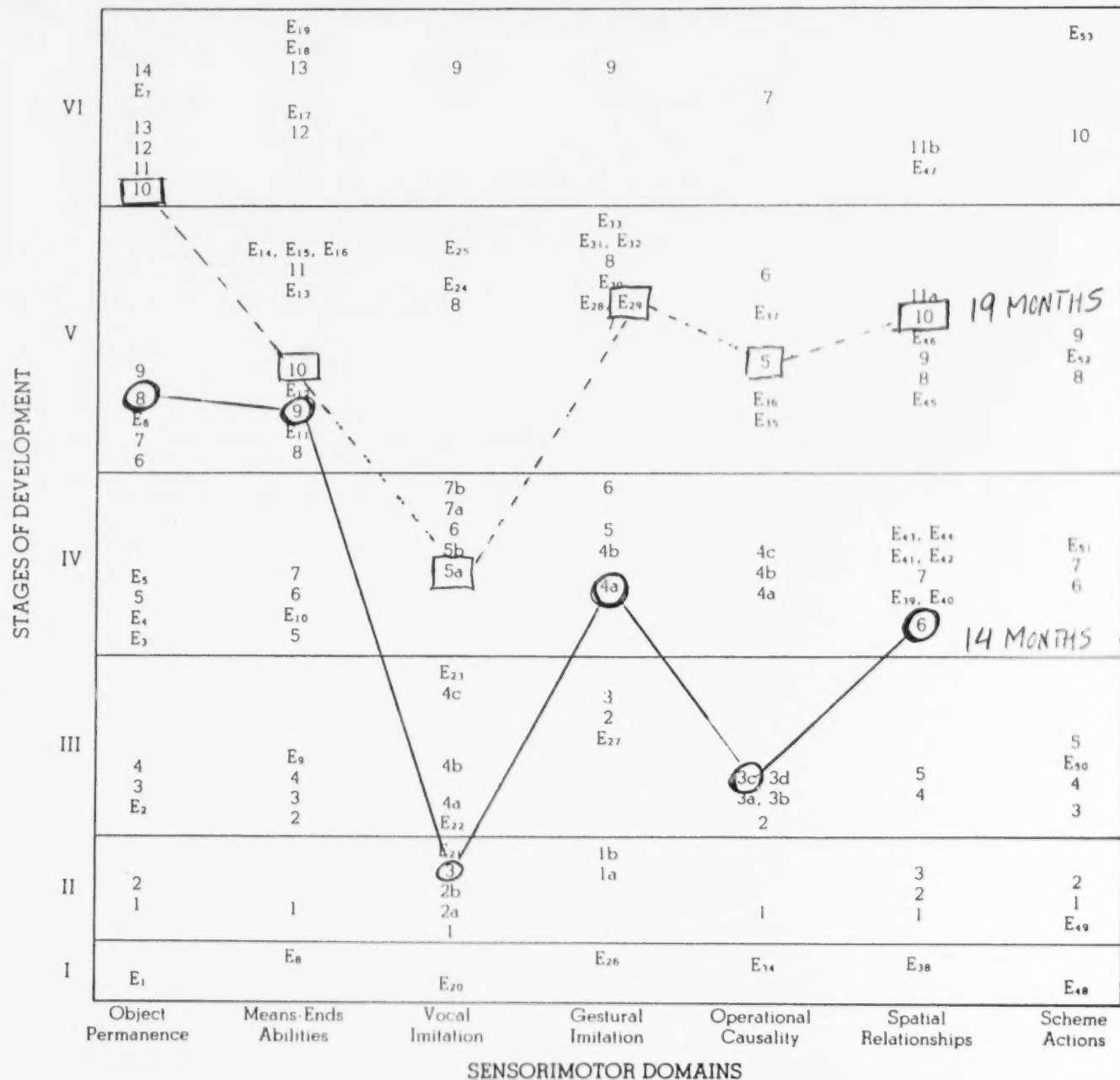


Figure 1. Christopher's Developmental Progress

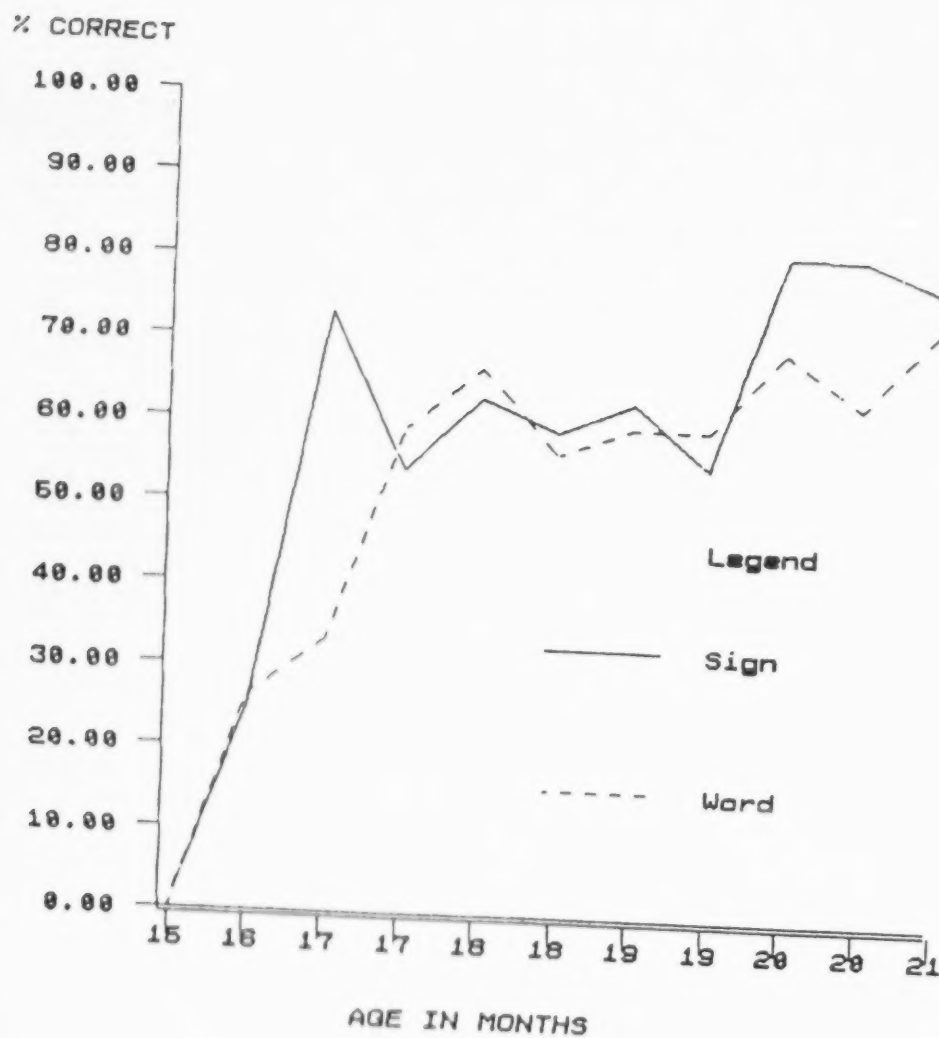


Figure 2. Comprehension of Target Words and TC Signs

words

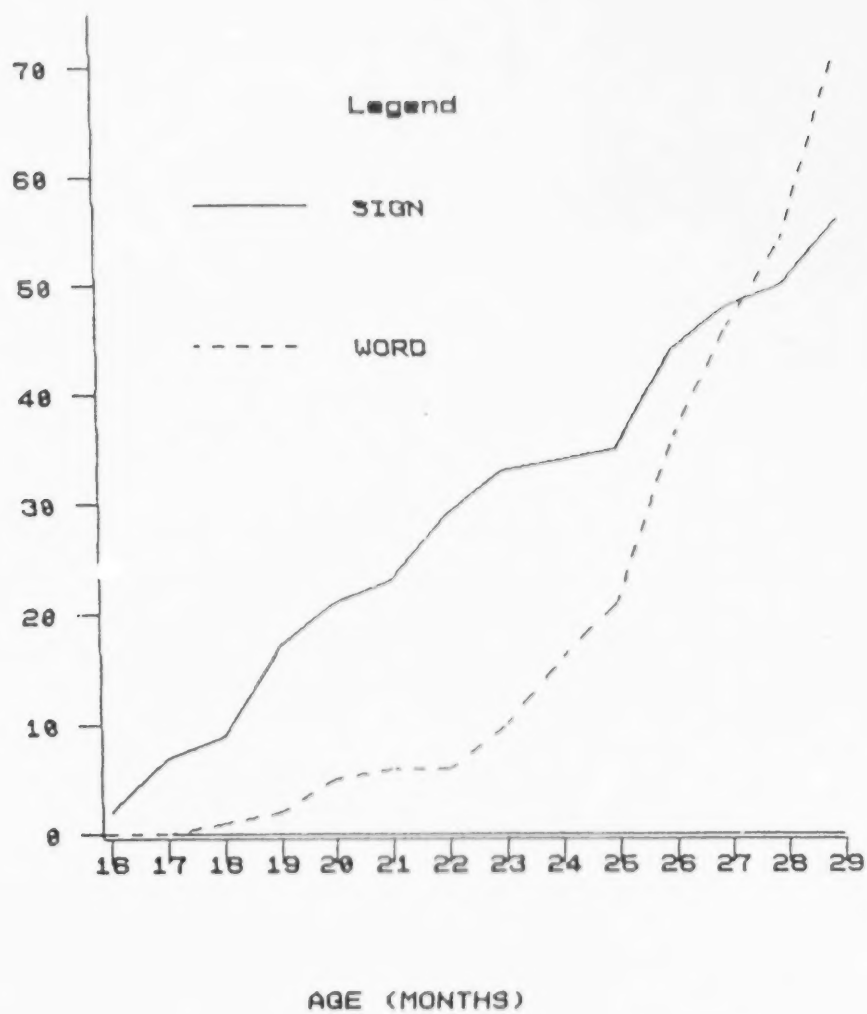
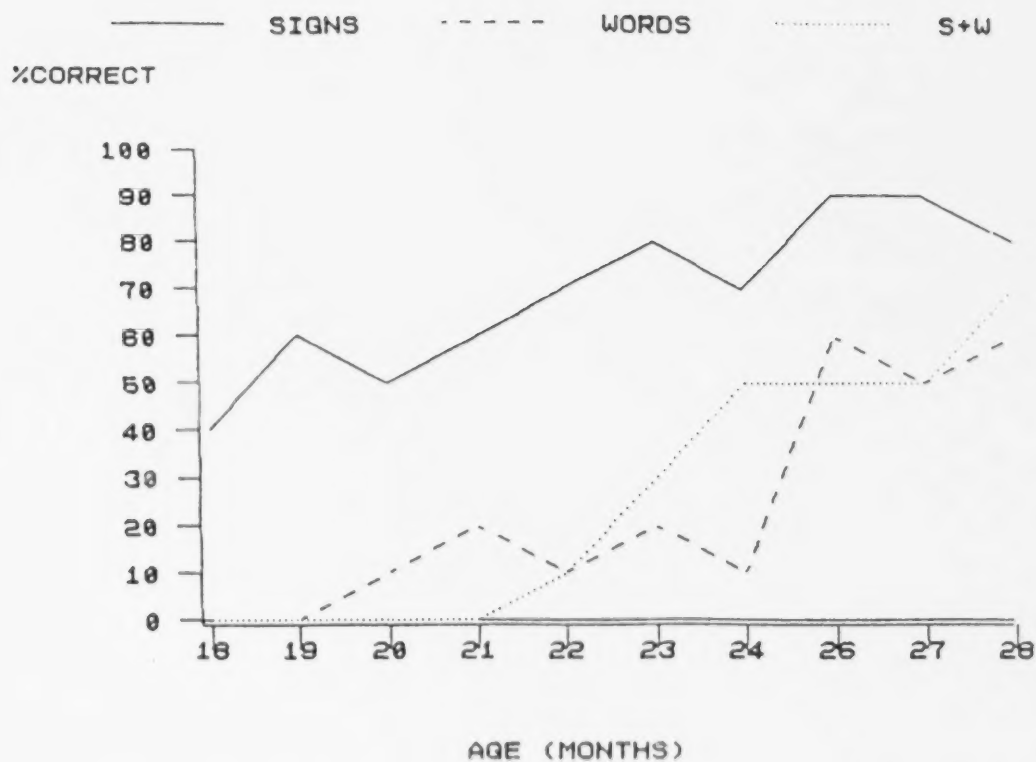


Figure 3. Expressive Vocabulary based on Parent Reports



Note. S+W represents the use of both Signs and Words for TC Condition
 Figure 4. Expression Testing of Words and TC Signs